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IEEE Recommended Practice for Seismic Design of Substations

IEEE Power and Energy Society

Sponsored by the
Substation Design Criteria Committee

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USA

IEEE Std 693™-2018
(Revision of
IEEE Std 693-2005)

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Abstract: Seismic design recommendations for substations, including qualification of different equipment types are discussed. Design recommendations consist of seismic criteria, qualification methods and levels, structural capacities, performance requirements for equipment operation, installation methods, and documentation.

Keywords: anchorage, conductor, electrical equipment, damping, dynamic analysis, IEEE 693™, loads, projected performance, required response spectrum, seismic protective devices, seismic qualification, shake table, static coefficient analysis, support structure, suspended equipment, time history

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Introduction

This introduction is not part of IEEE Std 693-2018, IEEE Recommended Practice for Seismic Design of Substations.

This revision of IEEE Std 693-2005 was developed as a recommended practice for the seismic design of substations. This recommended practice emphasizes the seismic qualification of electrical equipment. Nuclear Class 1E equipment is not covered by this recommended practice, but it is covered by IEEE Std 344™.

This recommended practice is intended to establish standard methods of providing and validating seismic withstand capability of electrical substation equipment. It provides detailed test and analysis methods for selected common equipment types of major equipment or components found in electrical substations.

This recommended practice is intended to assist the substation user or operator in providing substation equipment that will have a high probability of withstanding seismic events to predefined ground acceleration levels. It establishes standard methods of verifying seismic withstand capability. This gives the substation designer the ability to select equipment from various manufacturers, knowing that the seismic withstand rating of each manufacturer's equipment is an equivalent measure.

This recommended practice is also intended to guide the manufacturers of power equipment in the seismic design and in demonstrating and documenting the seismic withstand capability of their product in a form that can be universally accepted.

Although most damaging seismic activity occurs in limited areas, many additional areas could experience an earthquake with forces capable of causing great damage. This recommended practice should be used in all areas that may experience earthquakes.

This revision of the recommended practice incorporates a number of substantive as well as editorial changes from the previous version. The most significant of these changes include the following:

— Shake-table test requirements for qualification of bushings have been modified;

— Conductor seismic loading effects are explicitly included as part of the qualification of certain equipment;

— Time history shake-table testing at the Performance Level is required for most equipment that are required to be qualified by the time history test method;

— Seismic loads for the design of anchorages of inherently acceptable equipment have been increased.

It is the hope of those who worked on the development of this recommended practice that these standard methods of verifying seismic withstand capability will lead to better earthquake performance and to lower qualification costs.

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